REMARKS

This response is submitted in reply to the Office Action dated January 2, 2008, issued in connection with the above-identified application. Claims 1, 3, 9 and 11 are pending in the patent application. In the non-final Office Action, claims 1, 3, 9 and 11 are rejected under 35 U.S.C. §103(a). For the reasons set forth below, Applicants respectfully traverse this rejection. The commissioner is hereby authorized to charge deposit account 02-1818 for any fees which are due and owing.

Applicants acknowledge and thank the Examiner for the telephone conference on March 7, 2008.

In the Office Action, claims 1, 3, 9 and 11 are rejected under §103(a) as being unpatentable over U.S. Patent No. 6,632,566 ("Yamada") in view of U.S. Patent No. 5,631,100 ("Yoshino.") As was discussed during the telephone conference, Applicants respectfully disagree and traverse this rejection by argument. In the application, claims 1 and 9 are the independent claims, both containing parallel language requiring a cathode mixture layer that contains a cathode active material and a binder including a styrene butadiene latex adhesive (hereinafter "SBR") and a thickener. The content of the SBR in the cathode mixture layer ranges from between about 2 wt% to about 4 wt%, and the content of the thickener in the cathode mixture layer ranges between about 0.5 wt% to about 2.5 wt%. The thickener is polyacrylic acid and the cathode active material is lithium iron phosphorous oxide ($LiFePO_4$) having an olivinic structure. Claims 3 and 11, which depend from claims 1 and 9 respectively, require the further limitation that the cathode mixture layer contains a carbon material as a conductive agent, wherein the carbon material ranges from about 5 wt% to about 12 wt% with respect to the total amount of cathode active material and carbon material.

As the Examiner has noted, Yamada discloses a cathode containing the compound $Li_xM_yPO_4$ that has an olivinic structure. $LiFePO_4$ is specifically disclosed. Yamada states that any known suitable binder routinely used as a binder for positive electrode active material may be used. Col. 6. lns. 41-46, but gives no further details or discussion. Experiment #1 does give a synthetic example, where 70% weight $LiFePO_4$, 25% weight acetylene black, and 5% weight polyvinylidene fluoride (PVDF) as a binder were used to prepare a cathode. Col. 10, lns 9-15. As the Examiner has noted, Yamada does not teach a binder containing SBR and a polyacrylic

acid thickener. Note also that Yamada does not teach a cathode with the 5-12% weight carbon material as a conductive agent, as required by dependent claims 3 and 11.

In order to supply the elements of the claims absent from Yamada, the Examiner has asserted Yoshino discloses the proposed range of SBR and polyacrylic acid for the cathode mixture layer present in the instant claims. Yoshino discloses secondary batteries comprising an organic electrolyte with low water content, a positive electrode of lithium containing composite oxides as cathode active material, and a negative electrode of carbonaceous material as anode active material. At least one of the electrode active materials is dispersed in a binder and coated onto an electrode, and the binder has a distribution coefficient that is relevant to the Yoshino invention. Yoshino indicates no limitation to a particular binder, and suggests at least 12 different binders. Col. 6, lns 46-53. SBR and PVDF are included in that list. The range of binder content is listed as from 0.1 to 20 parts by weight (pbw) of binder per 100 pbw of electrode active material, preferably 0.5 to 10 pbw of binder per 100 pbw of electrode active material. Col. 7, lns. 6-9 and col. 7 ln. 62 to col. 8 ln. 4. When the binder is a water-soluble polymer like SBR, a thickener may be added in an amount between 2 to 60 pbw per 100 pbw of the binder. Yoshino lists nine examples of thickeners, including polyacrylic acid.

Applicants assert that the combination of Yoshino and Yamada fail to make the instant inventive claims obvious. As the Applicants have asserted in a previous response and in the telephone conference, the only support for the SBR and polyacrylic acid in a cathode mixture layer is provided by the broad description in columns 7 and 8 that this binder combination is found on an electrode. Claim 1 in Yoshino provides that a coating composition containing a binder must be on at least one of the anode or cathode, and claim 3 provides that the binder comprises SBR, although it fails to state any ratios and does it mention thickeners. Furthermore, nowhere in the specification does Yoshino teach specific examples of SBR and polyacrylic acid as part of a cathode mixture layer. The specification in column 8 provides extensive discussion of SBR and a thickener on an *anode*. Examples 17-30 teach the SBR and a thickener (carboxymethyl cellulose) on an *anode*. Examples 1-16 teach *cathode* preparation, but only teaches the use of *PVDF*. Note that both Yoshino and Yamada provide specific examples of cathode preparations, both using PVDF, suggesting that SBR-polyacrylic acid may not be appreciated as viable for cathode preparations.

More importantly, Applicants assert that the combination of Yoshino and Yamada still fail to make the instant inventive claims obvious. The Examiner, in the Response to Arguments in the Final Office Action, stated on page 4 that "It is unclear how the Applicants conclude that [Yoshino] teaches away from the claimed range when the claimed range is encompassed by the prior art." Applicants assert that Yoshino does not completely encompass the claimed range. because Yoshino does not teach at least part of the ranges of SBR and polyacrylic acid present in the inventive claims, and because the other part of the ranges present in the inventive claims provide unexpected results that distinguish it from Yoshino.

The issue is that the units used in Yoshino and the claimed invention are different. The claimed invention describes the amounts of SBR and polyacrylic acid as a percentage of the total weight of the cathode mixture layer. The units in Yoshino are quite different, and cannot be compared directly to the inventive claims. The binder content is described as x pbw *binder* per 100 pbw of *electrode active material.* And the thickener content is described as x pbw *thickener* per 100 pbw *binder*. For example, a cathode mixture layer in the instant specification containing only SBR, polyacrylic acid, and $LiFePO_4$ with 2 wt% SBR and 2 wt% polyacrylic acid would have 96% by weight of $LiFePO_4$ (100-2-2=96). In contrast, a mixture in Yoshino that has 5 pbw binder and 30 pbw thickener (the midpoint of Yoshino's preferred ranges) converts to 4.7% weight SBR with 1.4% weight thickener. The values must be converted to evaluate the data on the same scales.

The determination of pbw for SBR from the instant application is problematic, as noted above, because the %weight of SBR is a function of the total weight of material present in the cathode mixture layer, including SBR, polyacrylic acid, the amount of cathode active material, and also any carbon material in the cathode mixture layer (see claims 3 and 11.) The determination of pbw for polyacrylic acid from the instant application is less problematic. This comparison is simply the ratio of %weight polyacrylic acid to %weight SBR. Taking the highest and lowest numbers claimed for polyacrylic acid and SBR, and assuming that only SBR, polyacrylic acid (PAA) and cathode active material are present, the following table can be constructed:

| Endpoint Values of Claimed Invention | | Conversion to Values as Used in Yoshino | |
|---|---|---|---|
| %wt SBR | %wt PAA | pbw PAA | pbw SBR |
| 4 | 0.5 | 12.5 | 4.2 |
| 2 | 0.5 | 25 | 2.1 |
| 4 | 2.5 | 62.5 | 4.3 |
| 2 | 2.5 | 125 | 2.1 |

What becomes quickly apparent from this calculation is that the claimed ranges for thickener only partially falls within the range present in Yoshino. Furthermore, while the SBR range does fall within the range of Yoshino, it is in fact a rather small range. Yoshino discloses a binder range of 0.1 to 20 pbw, preferably 0.5 to 10 pbw, per 100 pbw active material, and a thickener range of 2 to 60 pbw per 100 pbw binder. The claimed range for binder in the instant application is a much narrower sliver of the preferred range in Yoshino. And as stated on page 6 of the instant application, values outside of this range fail despite the suggestion from Yoshino that they would work. Similarly, the claimed range of thickener only partly falls within Yoshino's disclosed range.

Data set forth in the examples of the instant application supports this conclusion. A comparison of Examples 1-1, 1-2, 2-1 and 2-2 in Tables 1 and 2 demonstrate amounts of SBR of polyacrylic acid that fall within the claimed range and demonstrate sufficient to strong results in peal strength. In contrast, Comparative examples 1-1, 1-2 and 2-1 demonstrate amounts of SBR and polyacrylic acid that fall well within the preferred ranges of binder content set forth in Yoshino, yet outside the range of the claimed invention, and fail to achieve the results in the claimed invention.

Based on this information, Applicants assert that the claimed ranges of binder and thickener in combination with a $LiFePO_4$ that has an olivinic structure is not made obvious by the combination of Yoshino and Yamada. The range of binder and thickener in the claimed invention in part falls outside of and in part occupies a small sliver of the preferred range disclosed Yoshino. Comparative examples demonstrate that points well within the preferred range disclosed in Yoshino fail for cathode mixture layers containing $LiFePO_4$ that has an

olivinic structure. But, the Applicants have determined that ranges of SBR and polyacrylic acid that presumably work for lithium oxide catalysts fails to work for $LiFePO_4$ with an olivinic structure. Surprisingly, a quite different range of SBR and polyacrylic acid works with olivinic $LiFePO_4$. Consequently, the Applicants assert that the claimed range is not obvious in view of the combination of Yamada and Yoshino, and respectfully request that the rejection be withdrawn.

Furthermore, Applicants assert that the combination Yamada and Yoshino does not render obvious claims 3 and 11. In Yamada the only support for adding carbon to the cathode mixture layer can be found at col. 10 lns. 11-12, where 25% weight acetylene black is added to $LiFePO_4$ with PVDF as a binder. In Yoshino, no discussion is present in the specification for including a conductive agent that is carbon *in the cathode*. In Example 1 of Yoshino, a cathode containing a lithium oxide and a pair of carbon agents is disclosed. However, first, that example contains PVDF as a binder with no thickener. Second, the binder is not greater than 2% weight of the cathode mixture layer (2/(100+2.5+2.5+2)=1.87%). And third, the percent weight of carbon with respect to the total amount of cathode active material and carbon material is 4.76% (5/105), which is outside the claimed range of 5-12%. Consequently, the combination of Yoshino and Yamada fails to disclose a cathode mixture layer containing olivinic $LiFePO_4$, 2-4% by weight SBR, 0.5-2.5% by weight of polyacrylic acid, and a carbon material as a conducting agent in 5-12% by weight with respect to the cathode active material and the carbon material.

For the reasons set forth above, the Applicants assert that claims 1 and 9, as well as claims 3 and 11, are patentable over the combination of Yoshino and Yamada. If the Examiner has any questions regarding this Response, Applicants respectfully request that the Examiner contact the undersigned attorney.

Respectfully submitted,

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